KYKLOS 4.0 newsletter #4

December 2021

An Advanced Circular and Agile Manufacturing Ecosystem based on rapid reconfigurable manufacturing process and individualized consumer preferences

In this edition of the KYKLOS 4.0 Newsletter, discover the latest news about the project, including the developments of the KYKLOS 4.0 components and their contribution to Circular Manufacturing, the results of the KYKLOS 4.0 Open Calls as well as an overview of KYKLOS 4.0' latest events

1. KYKLOS 4.0 **Funded Experiments**

Contents

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Open Call #1

The first round of experiments funded under the KYKLOS 4.0 project are under way. Seven projects, funded under the KYKLOS4.0 – Open Call #1, started last 1 November 2021 developing a broad range of digital manufacturing activities and will run for six months until 30 April 2022.

The KYKLOS 4.0 – Open Call #1 was published and launched on 1 April 2021 and closed on 30 June 2021. In total, 47 proposals involving 117 entities were submitted to the open call.

Submission highlights

The country with the highest number of participations in submitted proposals was Italy, with 34 participations, corresponding to approximately 30% of all participations. Furthermore, this corresponds to a participation in 17 of the 47 proposals submitted. The second highest participation is Spain, with 16 participations and 9 proposals submitted, followed by Greece with 11 participations and 6 proposals submitted.

Further looking into country participation, particularly by EU Member States, H2020 Associated Countries, and other eligible countries, most of the participation comes from EU Member States (94 of 117), with the remaining participation coming from Iceland (2), Norway (2), Serbia (3), Switzerland (4), Ukraine (4), Armenia (1), North Macedonia (1), and the United Kingdom (5).

Regarding the composition of the consortiums that submitted proposals, two analyses can be made. In terms of number of partners in the consortium, the distribution was balanced, with 23 proposals being submitted by a 2-partner consortium and 24 proposals with a 3-partner consortium (maximum eligible). In terms of participating countries in the consortium, 29 proposals were submitted involving partners from the same country, while 18 proposals had partners from one or more different countries.

All proposals were requested to identify one or more of the KYKLOS4.0 sub-domains to address as part of their own projects. Considering that proposals could address one or more sub-domains, the submissions received indicate that two sub-domains – 'Big data and data management' and 'circular manufacturing' – were addressed in 31 of the 47 (66%) proposals submitted. Furthermore, the domains of 'decision support systems' (26 proposals) and 'cyber-physical systems' (25 proposals) are present in more than half of the submitted proposals.

Selected sub-granted projects

From the 47 submitted proposals, 7 were invited to the contract preparation phase (15% success rate) and another 4 were kept in a reserve list. The geographical distribution of the top-ranked proposals show that highest number of participations came from Italy (7) followed by Spain (3). Greece, Portugal, and Switzerland each had one participation in the selected proposals. Regarding the proposals in the reserve list, Serbia had 3 participations, followed by Greece and Switzerland, both with 2. Regarding selected sub-domains, the top-ranked proposals focus on circular manufacturing (4 proposals), followed by deep learning, big data and data management, life cycle analysis, and cyber-physical systems, all being addressed in three proposals. It can be noted that during the contract preparation phase, one of the projects on the reserve list replaced one of the initially selected projects.
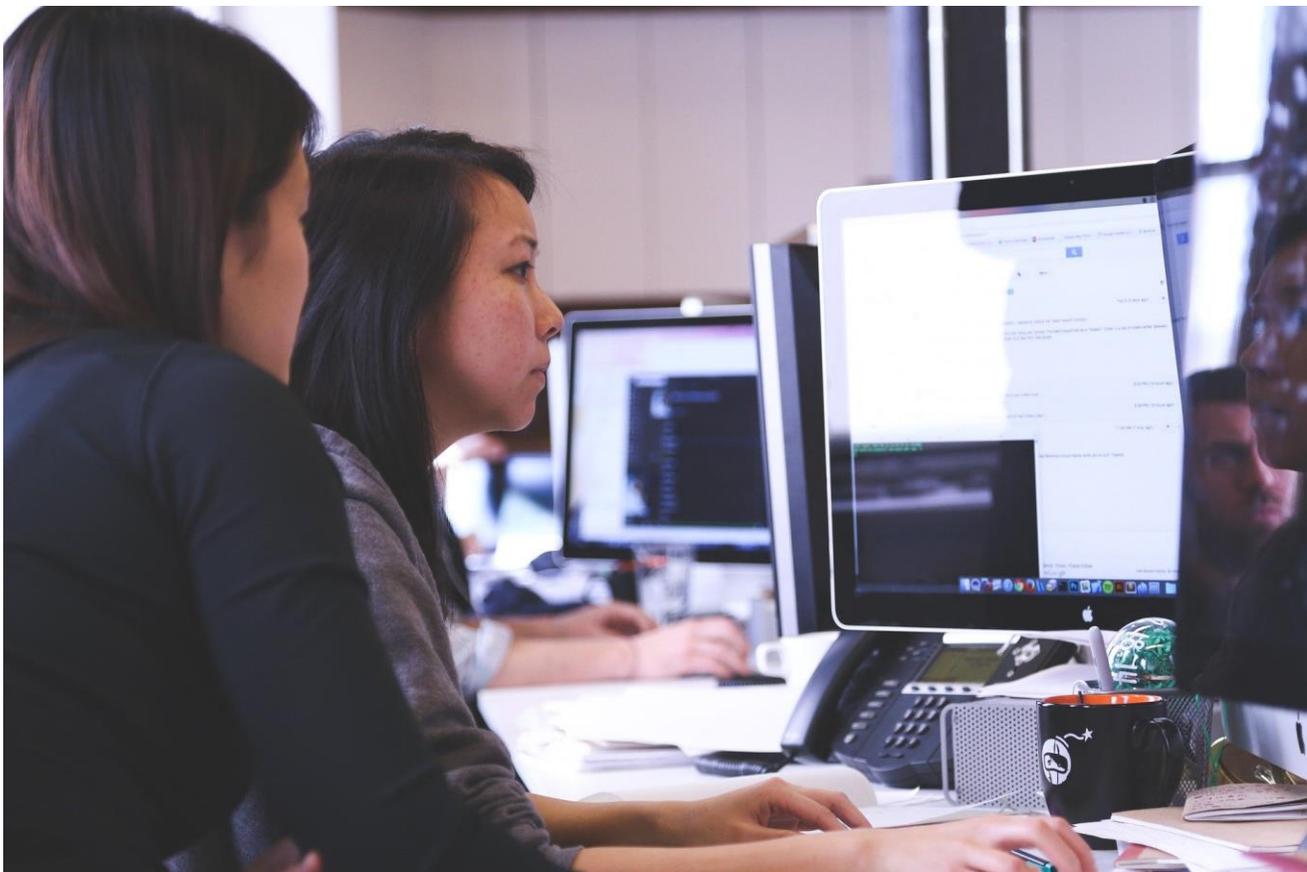

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Sub-granted projects overview

Title
ADDitivE MAnufActuring knowlEDgE MAnAgEMEnt (ADME)

Partners
SMASP REDES PROFESIONALES S.L. (Spain) [*Coordinator*]; Favoritanswer Lda. (Portugal)

Abstract

The aim of ADME project is to address the development of a decision-making support tool based not only on the information provided by the material suppliers but also based on inputs and know-how gained by manufacturing with these materials. The smart developed software tool will include process parameters, "non-catalogued". An innovative aspect will be also to allow the user to take a decision on the recyclability of the material used, which is becoming more and more relevant when choosing the material to be used. This tool will allow 3D printing companies, being able to use a wide range of AM polymer materials. They will be capable of making well informed decisions, keeping the acquired know-how "registered". This will provide the companies by even wider range of materials in the manufacturing of customized products, increasing the competitiveness of each company.

Title
Reconfiguring craft beer production towards circularity and individualized consumer preferences (BEERco2)

Partners
DNET (Serbia) [*Coordinator*]; Magnus Kraft (Serbia); INOSENS (Serbia)

Abstract

BEERco2 will create and validate a blueprint for technologies and activities which will enable small craft breweries to convert their production to the circular economy model as well as towards a consumer centric, on-demand, manufacturing. The BEERco2 solution will include the following elements: (i) sensors for measuring different parameters related to production inputs (temperature, water consumption, water pH levels); (ii) identity tags for encoding unique identity of the ingredients; (iii) edge IoT gateways for collection, initial processing and forwarding of the sensor measurements to the cloud subsystem and (iv) entry forms to capture other production data that is important for the overall process but not yet sensorized (identity of the cook, start date of the batch, etc.). This edge subsystem will be connected to the cloud business logic using KYKLOS 4.0 Interface (MI). KYKLOS 4.0 Cyber-physical Infrastructure will be also leveraged to accelerate deployment of the edge features, while PLM and LCA modules will be utilized for transparent provision of evidence related to the carbon footprint generated by the beer production.

Title
Deep learning-based errors Detection to boos Data-Driven Circular Manufacturing (D4CM)

Partners
Ce.S.I. Centro Studi Industriali (Italy) [*Coordinator*]; PAMA Spa (Italy)

Abstract

The objective of this project is to develop, implement and validate a robust and confident CPS platform that includes an AI-based machine Errors Detection and Adaptive compensation models relying on Deep Learning techniques. These models are developed with a holistic (from Design stage to Renovation) and modular approach that enables a quick and effective retraining and re-deployment in case of reuse of equipment, to foster circular manufacturing. This is fully in line with KYKLOS 4.0 approach and addresses the Deep Learning subdomain. D4CM kit solutions can be exploited as part of a distributed CPS system, where tools, hardware and software can be dynamically added or removed, and dynamically exchange information and collaborate. Deep learning and control models can both be re-used for 2nd live of machines and provide feedback to the Design stage for updating future machine developments. This modular and hierarchical approach will also enable the proper scalability of the concepts, according to user needs and then be replicated in different industrial contexts to build and foster resilience in circular manufacturing.

Title
Hybrid data-driven model for smart assessment of exploitable useful life of machine tools within circular manufacturing (DREAM)

Partners
KITENERGY Srl (Italy) [*Coordinator*]; SCORTA Srl (Italy)

Abstract

Containing operative costs (e.g., reducing machine tool downtime) and assuring quality are important aspects for the customers of machine tool builders to consider for an effective reuse of equipment. Quality, however, heavily depends on the condition of the equipment. At the end of the first lifetime (EO1L) of a machine tool the assessment of its exploitable life for reuse is of paramount importance to boost sustainable and effective circular manufacturing. Therefore, the objective of this project is to develop a Hybrid data-driven (AI + physics based) Decision Support platform able to: assess the actual exploitable life of machine components at EO1L; identify component that need to be replace and or remanufactured; assess the total cost of reuse of machine tools (for the second lifetime); and enable an effective predictive maintenance for the second life.

Title
Elliot Cloud For Industrial Manufacturing of FOOD processing companies (EFIM – Food)

Partners
Elliot Cloud SL (Spain) [*Coordinator*]; Vega Pelayo S.L. (Spain)

Abstract

EFIM-Food is proposing a solution for the food processing industries, to bring circularity to this type of industry. The main objective of the proposal will be to bring sustainability and circularity to traditional food processing companies thanks to the use of advanced technologies like Internet of Things, Artificial Intelligence, Life Cycle Assessment tools and support decision systems. EFIM Food will run a pilot at the factory of Vega Pelayo, where we will monitor and integrate the data of different parts of the manufacturing of a traditional dessert called "Sobao" (sponge cakes) which counts with a PGI (Protected Geographical Indication). The integration of the manufacturing process data, within a current manual process and obtaining indicators that measure how environmentally friendly is the process, will be an innovation as such for Vega Pelayo. EFIM Food will be a strategic project for the technology provider, Elliot Cloud. The additional components provided by KYKLOS 4.0 will allow Elliot Cloud to enhance the functionalities of its platform and scale up to a new segment of the market (like food processing companies) which is not yet exploited.

Title
Smart Pipes' Manufacturing Inspection, Testing and Life Cycle Analysis (METALICA)

Partners
Synelixis Solutions S.A. (Greece) [*Coordinator*]; EKSO S.r.l. (Italy)

Abstract

In this context, METALICA implements a novel, modular, configurable, and intelligent solution for lifecycle assessment and condition-based maintenance of pipes used in hydraulic networks. The solution will provide the means for gathering and analysing digital data about the conditions of the pipes towards optimizing their lifecycle management including their maintenance, services, repair, and other lifecycle management processes. In this direction, the project will develop an innovative digitally enabled lifecycle assessment tool for pipes, which will provide the means for optimizing both economic and environments parameters, while providing recommendations for resolving relevant trade-offs. METALICA introduces Digital Twin, Deep Machine Learning (ML) and Mixed Reality (XR) technology in the manufacturing of smart pipes for water distribution/irrigation and critical infrastructure to (a) Identify in near real-time (NRT) any smart pipe production discrepancy; (b) analyse and assess the produced pipes expected LCA/CBM; and (c) lead to smart pipes Zero Defect Manufacturing (ZDM).

Title
Polyethylene terephthalate fully-closed physical and digital circular thread (PET-CIRCLE)

Partners
TTS Technology Transfer System Srl (Italy) [*Coordinator*]; GR3N SA (Switzerland)

Abstract

PET-Circle proposes a pilot implementation of a PET-products circular value chain. Today, PET is already recycled, but the current process (based on purely mechanical treatment) degrades and downgrades the material performances, and consequently recycled PET is used for products that are less and less noble, whose destination can only be incineration, landfilling and, most of the time, dispersion in the environment. The proposed pilot will focus on two major pillars: 1) implementing in practice a small-scale circular value chain, having at its centre a new technology developed in the Horizon 2020 project DEMETO, GA-768573; 2) sustaining the "physical" side of this CE implementation with an adequate digital counterpart that manages the gathering, certification and exploitability of manufacturing and traceability data along the value chain.

Beside the pilot implementation, the proposal therefore faces some of the high-level challenges that are still standing for a fully digital industry and value chain, having direct impact on the implementation of circular principles: 1) the silo effect is still standing - interfaces are only partially developed and data systems are incompatible or not integrated one another; 2) lack of secure exchange of data; 3) lack of clear data ownership; 4) no effective and reliable LCA data sources for certification; 5) poor exploitation of IoT-enabled data streams.
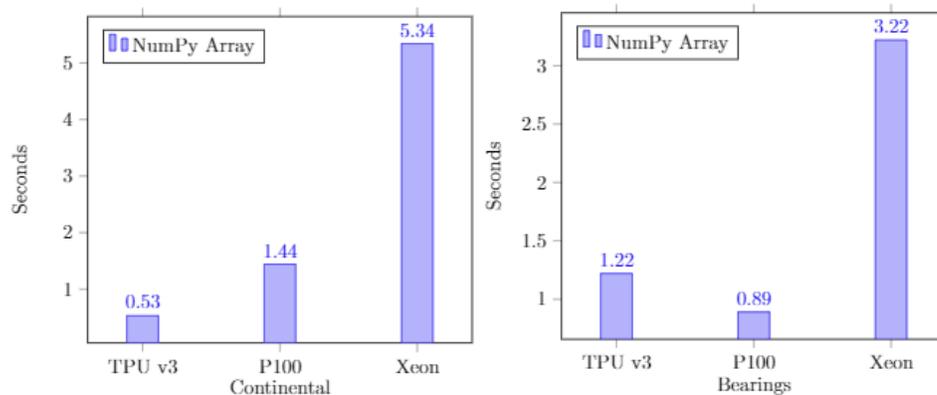
Read more about the funded experiments here.

Image from Pixabay.

2. KYKLOS 4.0 **Developments**

Testing LSTM on CPU, GPU, and TPU

In the context of the KYKLOS 4.0 project, an AI based predictive maintenance framework for industry 4.0 is being developed by Fraunhofer Fokus (https://www.fokus.fraunhofer.de/en/sqc/project/kyklos). As AI applications have huge computational demands, using GPUs and TPUs to run deep learning models is certainly an excellent option to accelerate the related performance. In this note, we would like to share some preliminary performance results we obtained by testing a LSTM model on CPU, GPU, and TPU. Two datasets were used, the first one is a small publicly available dataset1, reflecting a simple system with a shaft and four bearings. The second one, provided by the company Continental Romania, is larger, more complex, and describes the condition as well as the processes for a typical machine in an electronic production line. The platform for testing was Kaggle.

The undertaken tests show that for the Continental dataset (resp. the Bearings dataset), the processing time is reduced to almost 27% (resp. 27.6 %) when GPU is used instead of CPU, and to almost 10% (resp. 37.9%) when TPU is used instead of CPU. The reason that the Bearings dataset behaves better on GPU than on TPU can be explained by the fact that its size is not big enough, which makes it less cost-efficient to access the TPUs in the network. Indeed, the Bearings dataset has a format of (batch size = 128, 30, 28), however, the continental dataset has a format of (batch size = 128, 30, 42) and TPUs perform better with larger data batches and datasets. It is worth to mention that the TFRecords were not used here as the datasets are not big enough to be loaded efficiently from the google cloud storage.

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3. KYKLOS 4.0 **News**

KYKLOS 4.0 partner Jotne member of the European Alliance for Industrial Data, Edge, and Cloud

Image from Pixabay.

The thirty-nine confirmed first members of the European Alliance for Industrial Data, Edge and Cloud convened for the first time at a kick-off event hosted by the European Commission.

The main task of the Alliance will be to bring together a wide range of industrial players that are prepared to work together to strengthen the EU's position on the next generation of cloud and edge technologies. The Alliance will serve the specific needs of EU citizens, businesses, and the public sector to securely process highly sensitive data. It will define plans to develop the technologies needed for Europe's digital sovereignty. It will also provide a strategic platform to foster the competitiveness of the EU industry on cloud and edge technologies.

JOTNE will bring in its professional background from standards related to smarter data exchange and sharing processes for CAD, MBSE, PLM and Digital Twin utilizing ISO 10303, pat of ISO TC 184/SC 4 on Industrial Data.

For more information please click here.

KYKLOS 4.0 partner Jotne offers new solutions for the standard based Digital Twin

Image from Pixabay.

Jotne announces the new Digital Twin offering, EDMTruePLM with the IoT Open Source Eclipse Arrowhead Framework.

Download KYKLOS 4.0 presentation, leaflet, and posters

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